Instructive Feedback:
Effects of a Presentation Variable

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Instructive feedback involves presenting extra nontarget stimuli in the consequent events of instructional trials and not requesting students to respond to those stimuli during instruction. The purposes of this study were to evaluate whether students (a) would acquire the behaviors for instructive feedback stimuli when those stimuli were presented after trials on any of a set of target behaviors rather than after a given target behavior and (b) acquired instructive feedback behaviors *during* acquisition of target behaviors or *after* mastery of those target behaviors. Four 11-year-old boys with mild disabilities participated, instruction occurred in their special education classroom, and a multiple-probe design across sets of behavior was used. Results indicate that the students (a) acquired their target behaviors, (b) acquired a high percentage of the behaviors for instructive feedback stimuli, and (c) generally acquired instructive feedback responses while acquiring target behaviors. The findings are discussed in terms of future research on instructive feedback and implications for practice.

Instructive feedback is a modification of systematic instruction to allow students to learn extra behaviors (Werts, Wolery, Holcombe, & Gast, 1995). Instructive feedback involves adding extra nontarget stimuli to the consequent events of trials on target behaviors. During instruction, the teacher presents the target stimulus, provides an interval for a student response, delivers the consequences, and presents an additional stimulus (instructive feedback stimulus). Students are not asked to respond to the additional stimulus and are not reinforced if they do. Students—from preschoolers to adolescents—with a wide range of disabilities and levels of severity have acquired a majority of the behaviors for the instructive feedback stimuli (Werts et al., 1995). This finding occurred in one-on-one and small-group instruction and when trials were embedded in independent seatwork (Caldwell, Wolery, Werts, & Caldwell, 1996). It has occurred when delivered by researchers and teachers and even by peers (Collins, Branson, & Hall, 1995). Instructive feedback thus results in additional learning and is a desirable addition to direct instruction.

Despite replication, the mechanisms causing students to learn instructive feedback behaviors are not clear (Wolery, Werts, & Holcombe, 1993). Possible explanations include incidental and/or observational learning. Another explanation is that a relationship emerges between the target behaviors and the corresponding instructive feedback. This explanation is a possibility because in all studies reviewed by Werts et al. (1995), each instructive feedback stimulus was (a) assigned to a given target stimulus/behavior and (b) presented on each trial of the target behavior. An association thus is possible between the target stimuli/behaviors and instructive feedback stimuli/behaviors. Subsequently, continuous and intermittent schedules for delivering instructive feedback were compared, and both produced similar learning (Griffen, Schuster, & Morse, 1998).

Another question that came up is the following: When during instruction do students acquire instructive feedback responses? Performance on instructive feedback stimuli has been measured before instruction and after criterion on target behaviors (on a pre- and posttest basis). One study (Anthony, Wolery, Werts, Caldwell, & Snyder, 1996) compared the pre- and posttest measurements to daily probe sessions of the instructive feedback. Students acquired responses with both measurement systems, and the daily probes indicated that they acquired instructive feedback responses while learning target behaviors rather than after initial mastery. However, the daily probing may have produced learning by functioning as a demand situation (i.e., learn what the teacher tests daily).

The current study was done to extend the earlier work in two ways. First, instructive feedback stimuli were presented after any target behavior in a set being taught rather than after a given target behavior. This allowed us to test whether assigning instructive feedback stimuli to given target behaviors is necessary for learning instructive feedback responses. Second, the students' performance on instructive feedback stimuli was assessed after the first session in which they achieved 100% correct responding on target behaviors rather than after

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achieving criterion. This allowed us to assess whether the students acquired responses to instructive feedback stimuli while learning their target behaviors or after initial mastery, and it eliminated the potential effects of repeated assessments such as in Anthony et al.'s (1996) daily probing procedure.

Method

Participants

Four African American boys, each 11 years old, participated. They attended a special education class in an urban school the majority of the day but also participated in some general education classes (e.g., art, music, science). They had adequate auditory and visual acuity for the experimental tasks, responded to verbal requests, and used expressive language. None of the children had a history of instruction involving constant time delay or instructive feedback. They were taught in two dyads: Darius and Gabe, and Emile and Clint.

Darius (11 yrs 2 mo) had learning disabilities; he was the fourth of six children and lived with his mother and four siblings. He had been retained in first grade and started receiving special education services in second grade. On the *Wechsler Intelligence Scale for Children–Revised* (Wechsler, 1974), given at 8 years 3 months, his Full Scale IQ score was 83 (VIQ = 81, PIQ = 87). On the *Wide Range Achievement Test* (Jastak & Jastak, 1978), his standard scores were as follows: reading word recognition = 46 (percentile < 1), arithmetic computation = 67 (percentile = 1), and paragraph understanding = 45 (percentile < 1).

Gabe (11 yrs 4 mo) had learning disabilities; he was the seventh of eight children and lived with both parents and all his siblings. He had been retained in kindergarten and received Chapter 1 support until fifth grade, when he began receiving special education services. At 10 years 3 months, his Full Scale IQ score was 75 (VIQ = 80, PIQ = 74) on the *Wechsler Intelligence Scale for Children–Third Edition* (WISC-III; Wechsler, 1993). On the *Basic Achievement Skills Individual Screener* (BASIS; Psychological Corp., 1983), Gabe obtained a grade equivalent of 1-6 (standard score = 65, age equivalent = 6-0) in spelling, 1-3 (standard score = 65, age equivalent = 6-5) in reading, and 5-1 (standard score = 107, age equivalent = 10-7) in mathematics.

Emile (11 yrs 10 mo) had learning disabilities; he was an only child and lived with his mother. At age 2 he had been diagnosed with grand mal epilepsy, which was controlled by medication. At 10 years 4 months, he was diagnosed with dysthymia and major depression, single episode. At 11 years 7 months, he was placed on an antidepressant due to an overdose of his seizure-control medication. He received Chapter 1 support until fifth grade, when special education services were started. On the WISC-III, which was given at 9 years 9 months, Emile's Full Scale IQ score was 55 (VIQ = 70, PIQ = 48). On the *Wechsler Individual Achievement Test* (Psychological Corporation, 1992), he had a composite reading standard score of 71 (percentile = 3, grade equivalent = 1-7) and a composite math standard score of 83 (percentile = 13, grade equivalent = 3-2). The scores were incongruent with his class performance, and the tester noted his low scores were probably due to his depression and nonresponding.

Clint (11 yrs 4 mo) had mild mental retardation; he was the youngest of six children and had lived in foster care with his 12-year-old sister most of his life. He was reunited with his mother at the beginning of fifth grade; he lived with his mother, stepfather, an older sister, and a brother. Clint began receiving special education services in third grade. On the *Vineland Adaptive Behavior Scale* (Sparrow, Balla, & Cicchetti, 1984), given when Clint was 7 years 8 months, Clint had an overall age equivalent of 3 years 3 months. Age equivalents were as follows: communication, 2-5; daily living, 4-8; socialization, 2-9; adaptive behavior, 3-3. No other test results were available.

Setting and Materials

The setting was a self-contained special education class with 14 students, one special education teacher, and one assistant. Students sat at a table (1 m × 3 m) beside each other and across from the instructor. Other students worked with the teacher or independently during experimental sessions. Target and instructive feedback stimuli were printed on index cards (10 cm × 15 cm). The target stimuli (state outlines) were printed in black using Charisma software (Micrografx, 1990). Instructive feedback stimuli (words) were printed in lowercase letters (font was Universal 48 point).

Response Definitions and Data Collection

Responses recorded during probe sessions were *correct*—The student said the correct name of the state outline (target probe sessions) or said the word (instructive feedback probe sessions) within 3 s of the task question ("What state is this?" or "What's this?"); or *incorrect*—The student did not respond, indicated the response was not known, or said another state or word. During instructional sessions, responses were recorded as follows: *correct anticipation*—the student named the state outline within 3 s of the task question; *correct wait*—the student imitated the instructor's verbal model within 3 s; *nonwait error*—the student said any word other than the state name within 3 s of the task question; *wait error*—the student did not imitate the instructor's model; and *no response*—the student did not speak within 3 s of the model.

Experimental Design

A multiple probe design across sets of behaviors and replicated across participants (Tawney & Gast, 1984) with two conditions (probe and instruction) was used. Criterion was set at three of four sessions at 100% correct anticipations on a con-

tinuous reinforcement schedule and two consecutive sessions at 100% correct with reinforcement on a variable Ratio 4 schedule. Before data collection, three sets of target behaviors and three sets of instructive feedback stimuli were identified. Set 1 had two target and two instructive feedback stimuli; Sets 2 and 3 each had three target behaviors and three instructive feedback stimuli. The targets were outlines of states; the instructive feedback were words describing a commonality of the states in the set. Set 1 targets were *Arizona* and *Nevada,* and instructive feedback words were *pueblo* and *gila monster;* Set 2 targets were *Kansas, Nebraska,* and *Missouri,* and instructive feedback words were *rural, pioneer,* and *prairies;* Set 3 targets were *California, Florida,* and *New York,* and instructive feedback words were *celebrity, diversity,* and *megalopolis*. Individual assessments indicated that the students could not name the states or read the words.

Probe Procedures. The investigator individually assessed each student in separate sessions for target and instructive feedback stimuli. The same procedures were used in all probe sessions, and stimuli were intermixed with 3 trials per stimulus (24 total trials). Three sessions of each stimulus type occurred over a minimum of 2 days, with at least 45 min between sessions. The trial sequence was identical to that used by Caldwell et al. (1996).

Instructional Procedures. A 3-s constant time delay procedure identical to that used by Anthony et al. (1996) was employed. Trials were given individually, and both students in a dyad learned the same behaviors. Each student had four trials on each target behavior, with the order of presentation for behaviors and student turns determined randomly. Each instructive feedback stimulus was presented on four trials for each student in each session, and each stimulus was presented an equal number of times following each target stimulus. This differed from previous studies in which each instructive feedback stimulus followed a given target behavior on all trials. Instructive feedback was presented during praise for correct responses to the target stimulus. The instructor held up the card with the word (instructive feedback stimulus) and said, "Good, and this says ___."

If a student met criterion before his dyad partner, he received a single probe session. If 100% correct responses occurred, the probe condition was initiated; if less than 100% correct responses occurred, the student continued in instruction. If only one of the two students in a dyad was placed in a probe condition, instruction continued for the dyad partner who had not met criterion. Instruction on subsequent sets was initiated only when both students had completed the probe condition. If a student did not maintain correct performance in a probe condition, review sessions using instructional procedures were implemented.

Intermediate Assessment of Instructive Feedback. To determine if students learned the instructive feedback behaviors while learning target behaviors, instructive feedback stimuli were assessed in a probe session immediately after the first session in which a student had 100% correct anticipations on target stimuli. Only the instructive feedback stimuli for the set being taught were assessed; three trials per stimulus were presented using probe procedures.

Reliability Assessment

Interobserver agreement (IOA) data were collected across students in 28.6% to 33.3% of the probe sessions and 31.6% to 47.5% of the instructional sessions. The point-by-point formula (Tawney & Gast, 1984) was used. The IOA estimate in probes was 99.4% (100% for Darius & Emile, 99.2% for Gabe, 98.4% for Clint) and for instruction was 99.7% (100% for Darius & Emile; 99.6% for Gabe; 99.2% for Clint). Procedural fidelity was assessed in 30.4% (28.6%–32.1%) of the probe sessions and 37.3% (31.6%–47.5%) of the instructional sessions per student. Procedural reliability for probes was 100% for all instructor behaviors except for appropriate consequences (99.8%). For instruction, it was 100% for all behaviors except showing the correct stimulus and providing appropriate consequences (99.8%) and instructive feedback (99.7%).

Results

Percentages of correct responses for each target behavior set are shown in Figures 1 through 4 for Darius, Gabe, Emile, and Clint, respectively. Before instruction, each student's performance was at or near 0% correct, but instruction resulted in all students meeting the criteria for all behaviors. Probe conditions further removed from instruction tended to produce less correct responses. Review sessions for Set 1 behaviors were used for Clint because he had no correct responses in Probe 3. The number of sessions, percentage of instructional sessions in the dyad, percentage of errors, and number of minutes of instruction are shown in Table 1. For Darius, Emile, and Clint, the number of sessions for Set 3 was less than for Set 2, whereas the number was equal for Gabe. Errors occurred on less than 6% of the trials, and instructional sessions were about 2 min in duration.

Percentages of correct responses on instructive feedback probes (including intermediate probes) also are shown in Figures 1 through 4. Before instruction, the students had no correct responses. After instruction, their mean correct performance during probe conditions was above 80% correct. Darius and Clint had 100% correct responses on all instructive feedback stimuli in the final probe condition; Gabe was above 90%, and Emile was above 80%. These students thus acquired and maintained the instructive feedback responses despite the presentation of the stimuli following any—rather than a given—target stimulus/response. Intermediate instructive feedback probes occurred the first session in which each student had 100% correct responses on target behaviors (before meeting criterion). For Set 1, all boys had 100% correct responses on the instructive feedback; for Set 2, all had 100% except Gabe, who

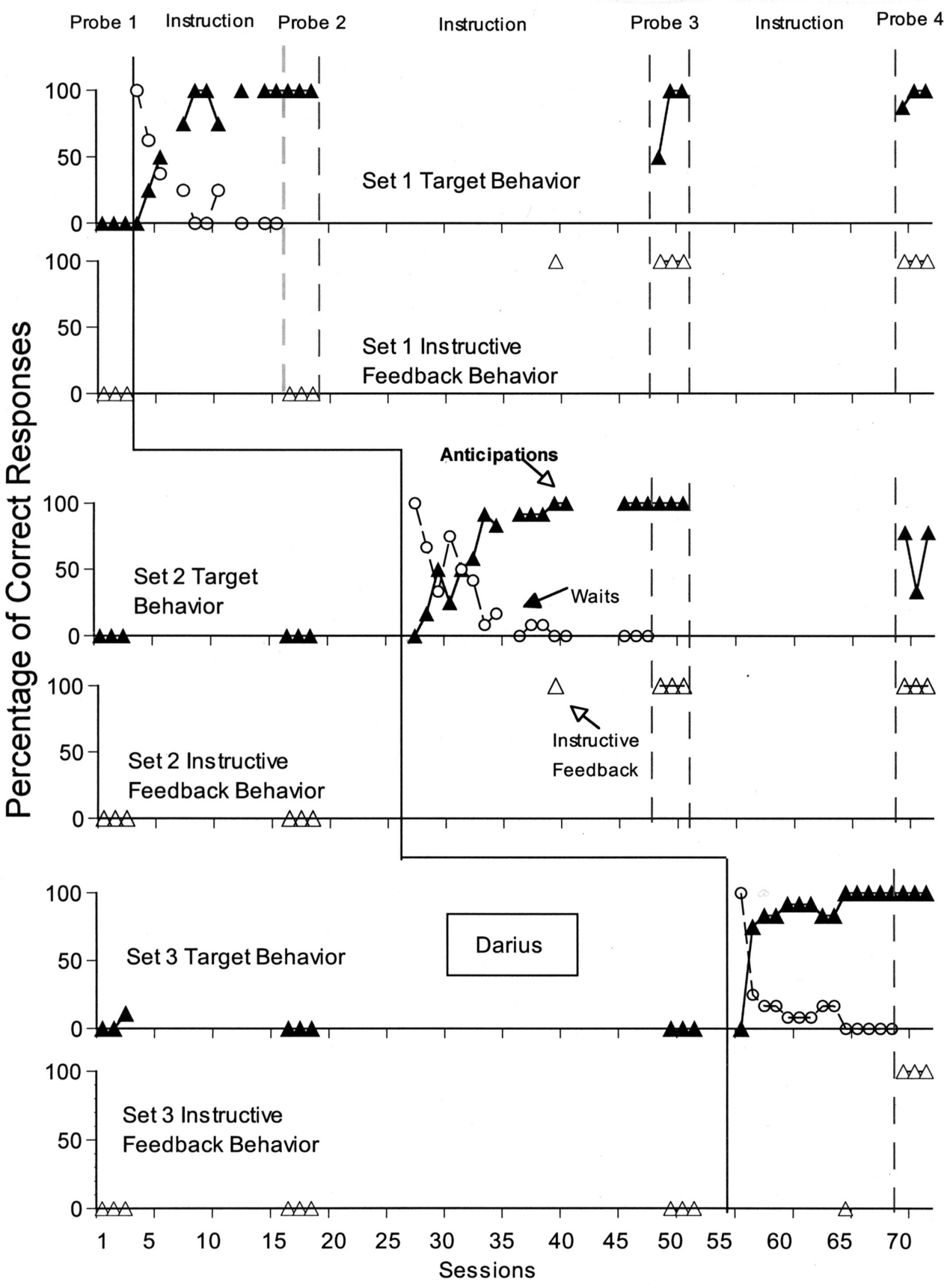

FIGURE 1. Percentage of correct anticipations (closed triangles) and correct waits (open circles) for Darius on three sets of target stimuli, and percentage of correct responses (open triangles) on instructive feedback stimuli.

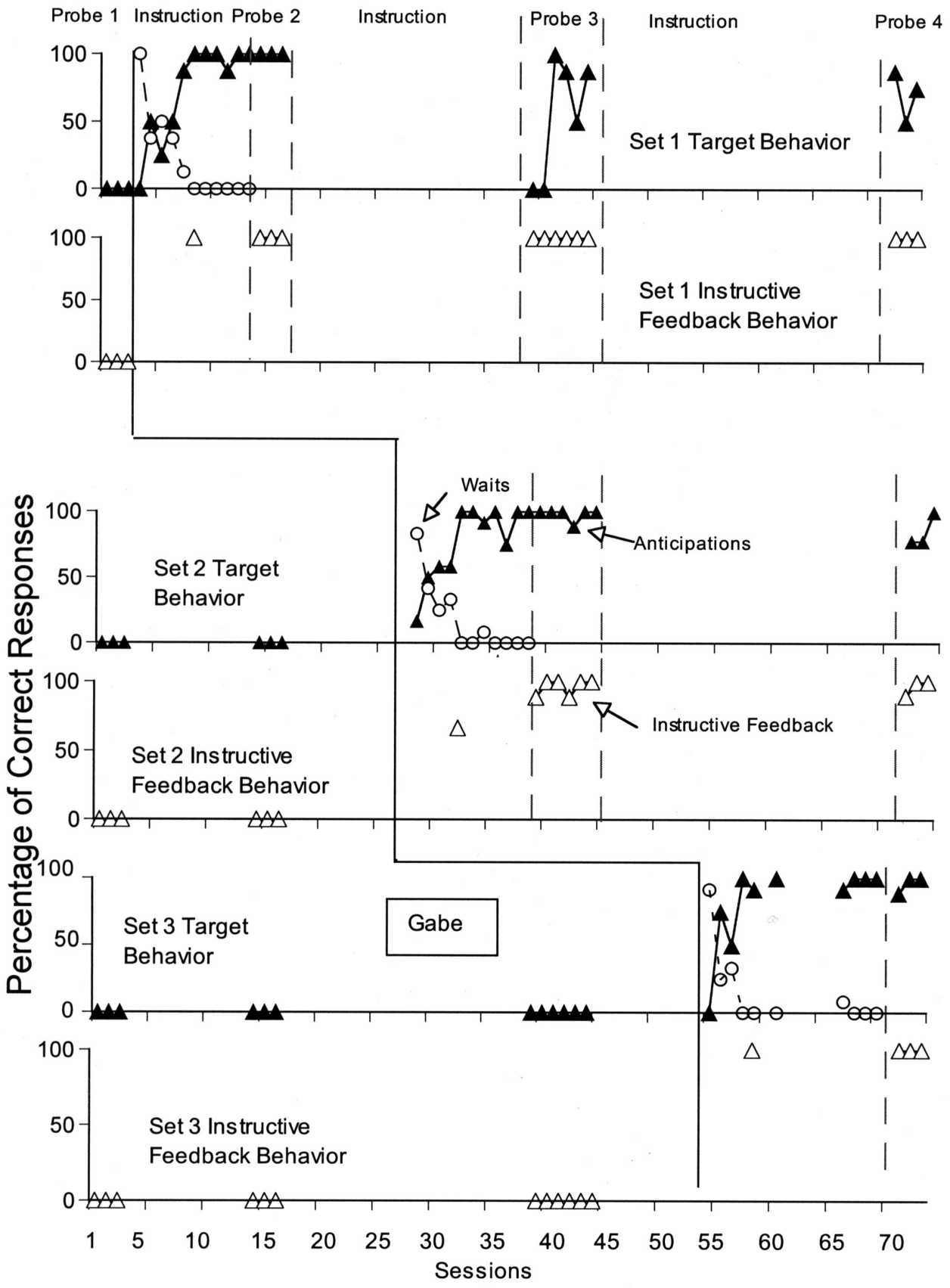

FIGURE 2. Percentage of correct anticipations (closed triangles) and correct waits (open circles) for Gabe on three sets of target stimuli, and percentage of correct responses (open triangles) on instructive feedback stimuli.

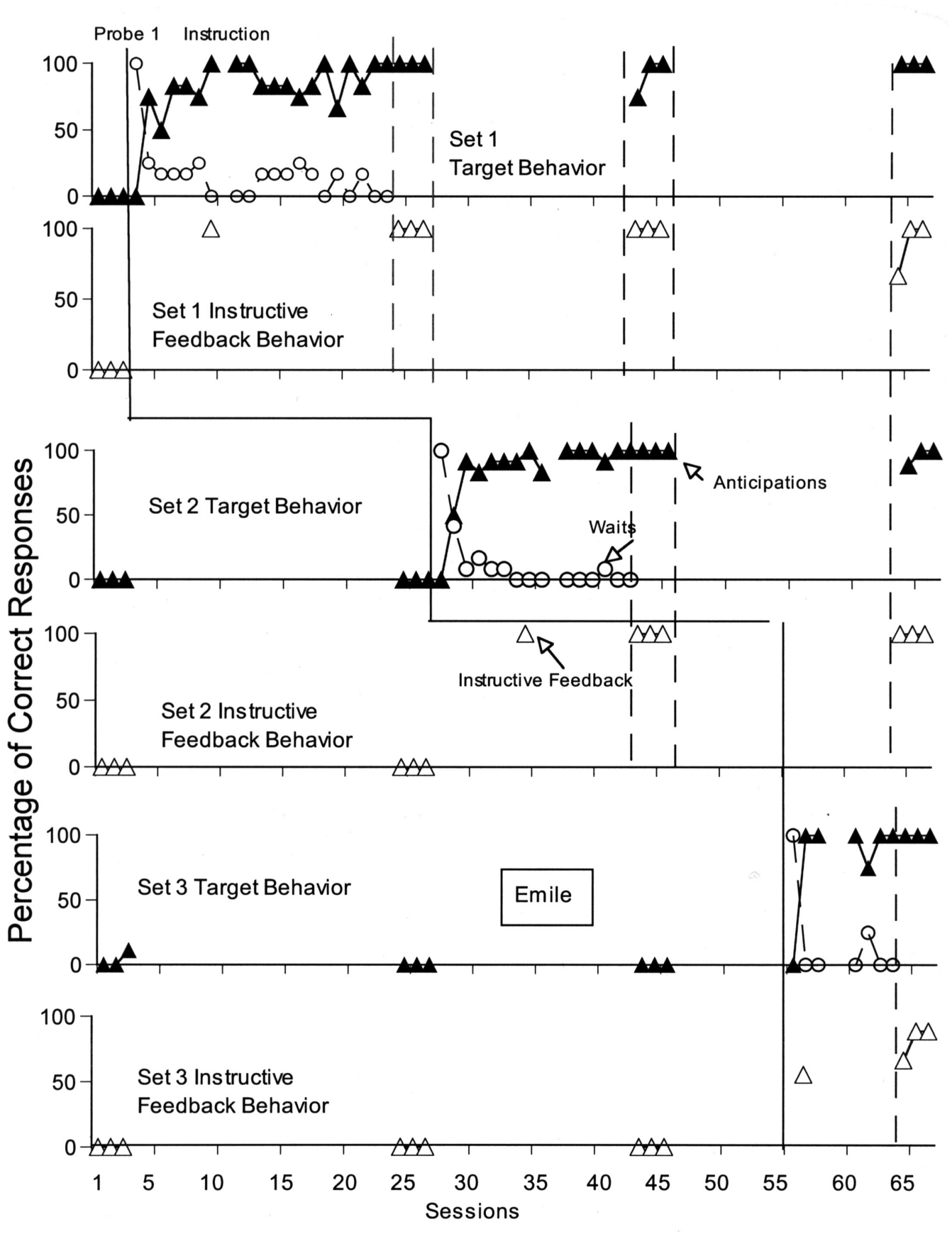

FIGURE 3. Percentage of correct anticipations (closed triangles) and correct waits (open circles) for Emile on three sets of target stimuli, and percentage of correct responses (open triangles) on instructive feedback stimuli.

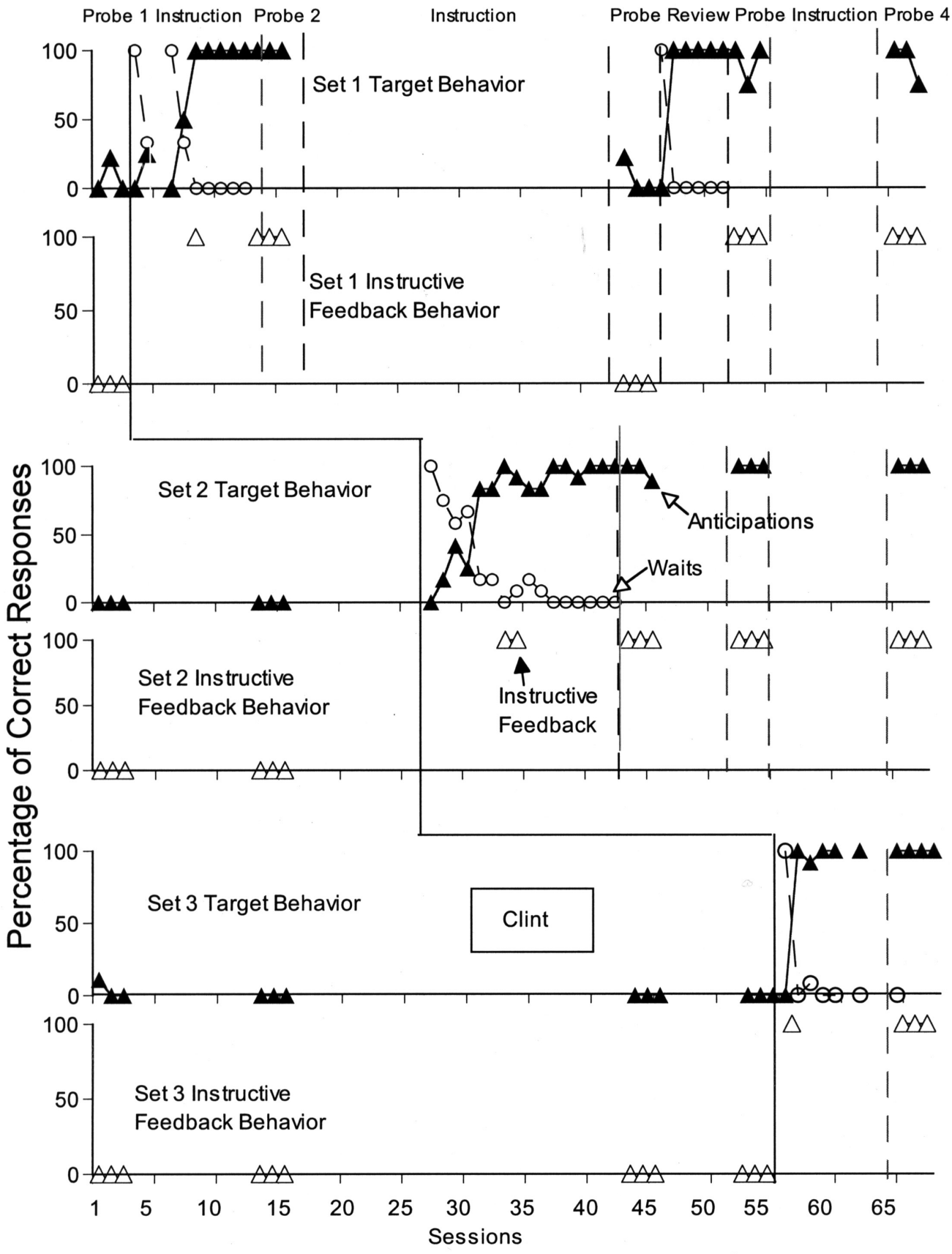

FIGURE 4. Percentage of correct anticipations (closed triangles) and correct waits (open circles) for Clint on three sets of target stimuli, and percentage of correct responses (open triangles) on instructive feedback stimuli.

TABLE 1. Number of Sessions, Percentage of Sessions in Dyad, Percentage of Trials with Errors, and Minutes of Instruction on Target Behaviors Through Criterion

Student & stimulus set	# of sessions	Sessions in dyad (%)	Trials with errors (%)	Time in instruction (min: sec)
Darius				
Set 1	10	80.0	2.5	18:35
Set 2	16	56.2	2.6	34:33[a]
Set 3	14	57.1	0.0	29:22
Total	40	62.5	1.6	82:30[b]
Gabe				
Set 1	11	72.7	5.7	21:26
Set 2	11	81.8	5.3	28:55
Set 3	11	72.7	3.8	22:24
Total	33	75.8	4.8	72:45
Emile				
Set 1	20	40.0	1.9	26:55
Set 2	15	93.3	2.2	39:31
Set 3	7	57.1	0.0	12:53
Total	42	61.9	1.7	79:19
Clint				
Set 1	9	88.9	5.6	16:35
Set 2	16	87.5	2.1	40:32
Review set	6	0.0	0.0	4:02
Set 3	7	57.1	0.0	11:49
Total	38	68.4	2.0	73:00

[a]Extrapolated because 1 of the 16 sessions was not timed. [b]Extrapolated because 1 of the 40 sessions was not timed.

had 66.7% correct; and for Set 3, Gabe and Clint had 100%, Darius had 0%, and Emile had 55.6% correct. Except for Darius on Set 3, the students appeared to acquire instructive feedback responses while acquiring the target responses.

Discussion

The acquisition of target behaviors, the more rapid learning of Set 3 over Set 2, and low error percentages replicated findings from other constant time-delay studies (Wolery, Ault, & Doyle, 1992), and the students' acquisition of instructive feedback replicated that of earlier studies (Werts et al., 1995). In this study, each instructive feedback stimulus followed each target stimulus in equal proportions and was not tied procedurally to a target behavior. Furthermore, after the students' first session of 100% correct target behaviors, their performance on the instructive feedback was assessed. Two new findings emerged. First, students acquired instructive feedback responses although the stimuli were not assigned to a given target behavior/stimulus—indicating it is not necessary to assign each instructive feedback stimulus to a given target stimulus. This finding diminishes (does not eliminate) the notion that students acquire responses for instructive feedback stimuli because of a unique relationship with target stimuli/behaviors (Wolery et al., 1993). Second, in previous instructive feedback studies (except Anthony et al., 1996), students' performance on the instructive feedback stimuli was assessed using a pretest/posttest format (Werts et al., 1995). Anthony et al. used daily probes of instructive feedback stimuli during instruction and found that students acquired instructive feedback responses while learning the target behaviors rather than during multiple sessions to demonstrate criterion. It should be noted, however, that daily probes may have caused students to attend to and acquire the responses. The current study eliminated the effects of daily probing as a confounding variable, but the data support Anthony et al.'s conclusion. Specifically, in most cases (Darius on Set 3 being the exception), students acquired instructive feedback responses while acquiring target responses. This is consistent with a finding from small-group instruction in which students were each taught different behaviors. In such situations, students learned their peers' behaviors observationally while learning their own behaviors rather than learning them in sessions used to demonstrate criterion (Wolery, Cybriwsky, Gast, & Boyle-Gast, 1991).

These two findings extend previous instructive feedback research. The recommendation to assign each instructive feedback stimulus to a given target stimulus is not warranted. Relationships may have emerged between sets of target behaviors and sets of instructive feedback, but this was not controlled. More flexibility in the presentation of instructive feedback stimuli thus is appropriate. Teachers can ensure an instructive

feedback stimulus from a set is presented after each trial on target stimuli. Also, the data suggest instructive feedback stimuli should be presented as instruction begins rather than after students have learned the target behaviors. In the three cases in which performance was not 100% correct on the intermediate probes, only Darius (Set 3) achieved 100% correct responding in the next probe condition.

Future studies should replicate these arrangements with a larger number of target and instructive feedback stimuli. The findings of this study may not hold when several target and instructive feedback stimuli are used. This study also could be replicated across a broader array of learners and behaviors. Stimuli (target and instructive feedback) for this study were selected for experimental expedience. The stimuli required discrete responses (making measurement easy) that were not being taught in the students' usual curriculum. As such, they were ideal experimental stimuli. We suspect more relevant stimuli would be learned more rapidly, but no direct data for these students are available to support this supposition. Other research could compare the condition from this study to the condition in which each instructive feedback stimulus is assigned a given target stimulus.

This study does not identify the causal mechanism for students' acquisition of instructive feedback responses, but it does diminish the claim that unique associations emerge between target behavior and instructive feedback responses. Observational learning is plausible as a mechanism because the students observed the teacher saying the word written on the card, and they could have acquired it observationally. Observational learning may have been enhanced because the model occurred in the context of reinforcement. To test this hypothesis, behaviors that are modeled but not delivered as instructive feedback could be compared to the use of instructive feedback. The observational learning hypothesis would be discounted if the participants only acquired responses to stimuli presented as instructive feedback, but it would not necessarily be the causal mechanism if responses to both stimuli were acquired.

Behavioral momentum (Mace & Belfiore, 1990), or interspersing known and unknown or easy and hard stimuli (Johns, Skinner, & Nail, 2000), may also explain the acquisition of instructive feedback. Interspersing the low-probability stimuli (instructive feedback) with the high-probability stimuli/behaviors (targets) would logically produce learning of instructive feedback responses. In instructive feedback studies, however, students are asked to respond to instructive feedback stimuli only during probe conditions; procedurally, this is quite different from the usual behavioral moment or interspersal paradigm. Behavioral momentum is time sensitive; that is, the interval between the high-probability behaviors and low-probability request should be quite short (Kennedy, Itkonen, & Lindquist, 1995). To test the behavioral momentum hypothesis, short intervals (2 s–3 s) between students' responses to target stimuli and the delivery of instructive feedback could be compared to long (10s–15s) intervals. If learning occurs only with short intervals, the behavioral-momentum explanation would be supported; but if learning occurred with both intervals, the explanation would not be supported. Regardless of the causal mechanism, children's acquisition of instructive feedback behaviors is a robust finding (Werts et al., 1995). Use of instructive feedback therefore is recommended when direct instructional trials are employed. Based on this study, the instructive feedback stimuli should be presented from the beginning of instruction and need not be tied specifically to given target behaviors.

AUTHORS' NOTES

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